VIRTUAL REALITY AS A TAX EDUCATIONAL TOOL IN DEVELOPING COUNTRIES

by

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ABSTRACT

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Background:

The application of virtual reality (VR) in education is an alternative teaching method that bridges the gap between theory-based and practical learning as it provides an opportunity to learn through computer-generated simulation. The adaptation of technology such as VR to facilitate education has the potential to enhance the understanding of relevant content. The attractiveness of VR as a teaching tool is its ability to deliver alternative teaching and learning experiences in the 21st century.

Main purpose of study:

The introduction of VR as part of the classroom experience in developing countries as an educational tool is one of the ways to further transform education. Furthermore, the integration of VR into education systems is one way of encouraging the use of technology to facilitate education. However, the use of VR in education is underexplored in developing countries, and there is little available research on VR in tax education in developing countries, which provides the opportunity for further research.

Method:

This study adopted the systematic review research method, where data is collected systematically from documents indexed in scientific digital libraries to ensure the evidence obtained to answer the research question is of the highest quality.

Results:

Digital technology, such as VR, promises improved student engagement that can lead to superior quality education. The benefits associated with its use in education clearly outweigh its disadvantages, and the effects of the barriers and limitations can be carefully mitigated or replaced with alternative options such as a controlled environment. However, consideration should be given to critical factors to be addressed for the involvement of academics to provide input for the correct design and deployment of VR technology that will be suitable in developing countries in Africa.

Conclusions:

Despite the limitations, disadvantages and barriers, VR has the potential to be successfully applied as a tax educational tool in developing countries in Africa. When the benefits are compared to the barriers, the use of VR can unquestionably be used as a tax educational tool in developing countries.

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation	Meaning
ABDC	Australian Business Deans Council
AI	Artificial Intelligence
COVID-19	Corona Virus Disease of 2019
5G	Fifth Generation of Cellular Networks
IR4	Fourth Industrial Revolution
THE	Times Higher Education
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America
VR	Virtual Reality

CHAPTER 1
INTRODUCTION AND PROJECT OVERVIEW

1.1 INTRODUCTION

"For the things we have to learn before we can do them, we learn by doing them". (Aristotle in Ross, Aristotle & Brown, 2009).

The application of virtual reality (VR) in education is an alternative teaching method that bridges the gap between theory-based learning and practical learning as it provides for an opportunity to learn through a computer-generated simulation of a three-dimensional image or environment. This image or environment can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. VR is a 3D immersive environment using special equipment to incite the operator's bodily existence of existing surroundings (Farshid, Paschen, Eriksson, & Kietzmann, 2018). The use of VR technology for educational purposes is not a new concept as research has been conducted on the use of VR in education since 1990 (Du Preez & Hill, 2021). Consequently, the use of VR in education in developing countries in Africa is not new; however, the prospects for research when applying VR in a learning environment has not been fully explored. This is paired with the pandemic caused by the Corona Virus Disease of 2019 (COVID-19) that required alternative ways of teaching.

COVID-19 has affected life in communities around the world and forced changes to education systems, working environments and even the way people socialise with one another. The COVID-19 pandemic is said to have brought technological advances that were not anticipated for several years to come (UNESCO, 2020). During the COVID-19 pandemic, international education organisations were required to rethink the future of education (Zewsde, 2020). The education community has shown resilience, and there has been significant science, technological and innovative interventions in higher education (Nzimande, 2021). One of the innovative technological interventions is the advancement of digital technology, which is a powerful tool that allows real-time communication, teamwork and learning from different geographical locations. There have been extensive developments in VR equipment and technology over the past century (Du Preez & Hill, 2021). This technology is readily available and requires aggressive adoption to enhance

education in developing countries in future. A post-COVID-19 era will entail acceding the traditional methods of teaching and adapting new technologies and more flexible methods of education (UNESCO, 2020).

The adoption of new technology and flexible methods to facilitate education, specifically the facilitation of taxation education, should be effective to enhance the understanding of the relevant content (Filer & Holmes, 2018). VR can effectively be used in the facilitation of tax education to create a simulation of a classroom that allows for real-time interaction. It also comes with the possibility to reform the way digital data is perceived in practice or in a learning environment (Zenner, Makhsadov, Klingner, Liebemann & Krüger, 2020).

The discussion commences with a background on the use of VR in education, which is further maintained by the literature review on the use of VR in education in countries with the best education systems in the world. The research method is then underlined, resulting in an examination and discussion of the research results and findings. Finally, this study addresses the research question and provides recommendations.

1.2 RATIONALE FOR THE STUDY

Since 1995 there has been major changes in the digital world with the increased use of cell phones and the internet, and currently most students want a learning space that closely align with how they use digital tools. Furthermore, it has been found that students believe facilitators underutilise digital tools that can create more varied learning experiences (Jukes, McCain & Crockett, 2010). This fact remains as students have access to more high-tech tools, such as multi-media images, sound and videos, that are driven by the broader movement called the Fourth Industrial Revolution (IR4), which could disrupt imminent employment roles as it presents new ways in which digital technology is entrenched and used in societies (Cooper, Park, Nasr, Thong & Johnson, 2019). The use of VR is linked to the IR4, and it is viewed as an enhancing tool with the ability to impact various aspects of everyday livelihoods. The COVID-19 pandemic further encouraged the use of digital technology when most of the universities in South Africa adopted online learning during the lockdown period in 2020 (Nzimande, 2021).

The introduction of VR as an educational tool in the classroom experience in developing countries is one of the ways in which further transformation in education can be adopted. One example of VR is exposing participants to a simulation of a classroom that essentially

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places the user in another world or dimension. This tool provides an alternative method to integrate learning for students without having to physically visit an employer's premises. Integrating VR into education systems is one way of encouraging the use of technology to facilitate education.

The educational pedagogy for the 21st century comprises of teaching and learning, curriculum development and the use of technology to facilitate education (Poe & Stassen, 2017). The aspect of using technology in education, particularly online teaching, has been neglected because facilitators were not familiar with the online environment (Poe & Stassen; 2017). The COVID-19 pandemic, however, demanded that both students and academia embrace the use of technology in education. The use of technology for online teaching during the lockdown were implemented at universities regardless of the challenges encountered. Some of these challenges include lack of sufficient facilities, resources and equipment required for online learning.

The challenges encountered to transition from the traditional face-to-face teaching to e-learning further required academia to be creative and to look for alternative ways to bridge the gap between the theoretical and practical aspects of learning. One of these alternative ways is the use of VR in education to deliver content to students in their fields of specialisation.

Despite the challenges, such as lack of facilities, resources and equipment, faced by developing countries in implementing VR in education, research on VR in education indicate that VR has a footprint in Africa. Furthermore, billions of Rands were invested in infrastructural equipment across South African universities during the lockdown in 2020 and during the 2021 academic year to enhance e-learning (Nzimande, 2021). A post-COVID-era education system will have to build on the innovation and investments made to enhance online learning and to explore the use of VR in education in Africa to enhance the learning experience of university students.

Research on applying VR in an educational environment has been conducted in developed countries, such as the USA, the UK and Australia, in some of the best ranked university systems in the world to explore the potential of VR as a tool for education (Cooper *et al.*, 2019; Times Higher Education [THE], 2021). However, the use of VR in education is underexplored in developing countries, and there is little available research on VR in tax education in developing countries, which provides the opportunity for further

research. Therefore, the following research question drove this study: What are the advantages and disadvantages of using VR as an educational tool in developing countries?

This research will contribute to institutions of higher education in developing countries adopting, exploring and embracing the available and upcoming digital market to produce the 21st century tax graduates as required by the IR4. The aim of the research was to determine the advantages and disadvantages of using VR as an educational tool.

1.3   RESEARCH PROBLEM

Before the COVID-19 pandemic, higher education was being criticises because it was believed that the traditional teaching methods used in higher education do not thoroughly cater for the graduate outputs required in the 21st century with reference to the technological aspects in education (Delello, McWhorter & Camp, 2015). During the COVID-19 pandemic, investigations into online education tools grew rapidly (UNESCO, 2020). The COVID-19 pandemic further exposed the need for digital technology such as VR to be adopted and embraced to produce graduates that are equipped with the right skill set for the emerging economies of the 21st century.

1.4   RESEARCH QUESTION

The research question for this study is:

What are the advantages and disadvantages of using VR as an educational tool in developing countries?

1.5   RESEARCH OBJECTIVES

The research question were supported by the following research objectives:

- To identify the reasons for the implementation of VR in tax education by analysing a sample of developed countries with the best ranked education systems;
- To compare the benefits and challenges of VR in tax education based on literature;
- To analyse the barriers hindering developing countries' implementation of VR as an enhancing tool for tax education; and
- To understand whether implementing VR in developing countries as a tool to enhance tax education is a sustainable solution.

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1.6   RESEARCH DESIGN AND METHODOLOGY

This study adopted the systematic review approach as the research method, where the data is collected systematically from documents indexed in scientific digital libraries to ensure the evidence obtained is of the highest quality to answer the research question (Burger, 2018). The literature was obtained using keywords, and the results were then categorised into themes.

1.6.1 Nature of Study

The type of research conducted is referred to as the nature of the research and there are different types of research (Duloch, 1993:150). The three types of research are described below:

- Historical research: This research strives to provide a historic or past narrative (Vithal, 2010:10).
- Descriptive research: This research strives to provide a link, relationship or correlation to the topic, as well as propose and recognise areas for further research (Duloch, 1993:154).
- Experimental research: This research strives to define or forecast the future by handling or varying different variables of present formulae to estimate future results (Vithal, 2010:10).

This study is qualitative descriptive in nature. A descriptive study is suitable when the researcher wants to describe the features of the phenomenon under examination (Leavy, 2017). It primarily uses words to define what is being detected and allows a detailed accurate examination (Booth, Sutton & Papaioannou, 2016:182). Descriptive research aims to find patterns and characteristics (Duloch, 1993:154). This research conducted a review of descriptive studies to provide a detailed account of the characteristics and patterns of VR in education in developed countries with the best ranked education systems in the world and compared the results to the education systems of developing countries in Africa.

1.6.2 Sampling

A convenience sampling approach were used (Creswell, 1998). An extensive literature survey was adopted, and a selection of a sample of the top 10 ranked universities with the

best ranked education systems in the world where VR in education is present and as available data permits were reviewed (THE, 2021). A comparison between the top 10 ranked universities in the world and the top 10 ranked universities in Africa where VR in education has its footprint was undertaken to determine the advantages and disadvantages of using VR as an educational tool (THE, 2021). The THE World University Rankings 2021 is the largest and most diverse university ranking with more than 1 500 universities across 93 countries and regions (THE, 2021). Once the convenience sample were selected, the method to identify the literature relevant to VR in education were considered.

The method used to identify literature and other significant information for this study is clearly described in Chapter 2. This includes the details for the inclusion and exclusion benchmarks applied in collecting the applicable information that were used to analyse the current knowledge related to VR in education. Universities selected as part of the sample where the medium of instruction is not English were automatically excluded from the sample. Only universities with English as the medium of instruction for its education system were included in the sample to ensure a better understanding of the content at the university.

1.6.3 Data Collection

A systematic review strategy was used for this descriptive study to explore available studies on VR in education. A systematic review attempts to categorise data directed towards a definite conclusion of a study. The systematic review process was conducted in the following phases: The formulation of a focused question, the development of criteria for the focused question, obtaining the relevant literature, assessing the quality of the literature, and finally, synthesising the information from the relevant literature (Khallaf, Naderpajouh & Hastak, 2017).

The focal point for the systematic review was the formulation of the research question:

- What are the advantages and disadvantages of using VR as an educational tool in developing countries?

The next step was to develop criteria for the focused question above. The criteria used to obtain literature addressed these research objectives:

- To identify the reasons for the implementation of VR in tax education by analysing a sample of developed countries with the best ranked education systems;
- To compare the benefits and challenges of VR in tax education based on literature;
- To analyse the barriers hindering developing countries' implementation of VR as an enhancing tool for tax education; and
- To understand whether implementing VR in developing countries as a tool to enhance tax education is a sustainable solution.

Thirdly, the literature were obtained from credible sources by using keywords relevant to the study, and the quality was assessed to ensure the reliability of the sources.

Finally, the literature that met the criteria to be included in the study were synthesised by sorting it systematically and analysing it.

1.6.4 Ethical Considerations

The integrity of collecting information, interpreting information, and drawing conclusions in the research is known as the ethics in research (Fouka & Mantzorou, 2011:3). In this study data were collected using secondary sources, and all these sources are included in the list of references to give credit to the authors. No primary data such as interviews, surveys, questionnaires or observations were used, and thus no ethical code for human participation were necessary. The ethical principles applicable to this study are honesty, referencing and avoiding research bias (Thomas & Hodges, 2010).

1.6.5 Trustworthiness

Literature such as journal articles in well-known publications and conference papers of well-known authors in this discipline were obtained from trustworthy sources such as Google Scholar and the University of Pretoria library to warrant its credibility.

1.7 STRUCTURE OF THE MINI-DISSERTATION

1.7.1 Chapter 1: Introduction and Project Overview

This chapter forms the background on the use of VR in education and briefly introduces the research problem, research question and research objectives. The knowledge gap and the need for further research is highlighted in this chapter. It further provides an overview of the research design and methodology that applies to the research.

1.7.2 Chapter 2: Research Design, Methodology and Literature Review

This chapter focuses on the research design methods that were used for the research. The steps involved in identifying the relevant academic literature for the study is described in this chapter. This chapter further analyses the research design elements of the literature identified for the research. The systematic review is conducted and explained in this chapter. The relevant literature reviewed is synthesised and evaluated. The ethical considerations relevant to the study is considered and a conclusion is drawn on the literature.

1.7.3 Chapter 3: Data Analysis and Presentation of Results

This chapter presents the detailed findings of the analysed data. The information required to ensure that the research aims are met is presented in a clear manner, including the ethical considerations relevant to the study. A conclusion is drawn on the literature.

1.7.4 Chapter 4: Conclusion

The discussion concludes with the research question being addressed to wrap up the study. Finally, this chapter explains the limitations on the study and make recommendations for future research.

CHAPTER 2
RESEARCH DESIGN, METHODOLOGHY AND LITERATURE REVIEW

2.1   INTRODUCTION

In this chapter the research design of the study and the method of obtaining the literature relevant to the study is explained. The method for conducting the systematic review entails documenting the process followed to obtain the relevant literature, using databases to identify and record the literature, and applying inclusion and exclusion criteria. The method to search for the relevant literature using key words is thoroughly described to confirm the precise way the articles were acquired. A high-level summary of the literature reviewed is discussed, followed by a conclusion for this chapter.

2.2   RESEARCH DESIGN

This section provides a discussion of the implementation plan for the research to address the research question and to obtain the research aims. The research design focuses on the framework for the research study by describing the category of study, the type of information used in the research and the system of analysis used to address the research question (Goddard & Melville, 2004).

2.2.1 Philosophical Stance of the Study

Research philosophy is the conviction structure that governs the study in interpreting the results of the study (Stahl, 2014:1). The following three categories of philosophical approaches can be used:

- Positivism: This approach ignores human belief, opinions and sentiments (Sekaran & Bougie, 2016:28). Positivism is the main form of scientific knowledge derived by direct observation and unbiased measurement (Kaboub, 2008:343).
- Interpretivism: This approach requires research to be conducted from people's perspective and their view of the world. It relies on individuals' personal views of the situation being studied (Patton, 2015:127).
- Pragmatism: This approach does not dictate the research approach that are followed and assesses philosophies based on their reasonableness (Morgan, 2014:1046).

This study took a pragmatic philosophical approach. In answering the research question, it recognised that significant value can be obtained from both the unbiased and biased interpretation of the meaning. The study sought to be practically relevant to the current need for expanding the methods of teaching in developing countries in Africa.

2.2.2 Nature of the Study

Studies can be classified according to its nature as either causal, descriptive or exploratory. The nature of a study is selected by considering what is known about the research topic and what the research aims to achieve (Sekaran, 2003:119).

Causal studies are conducted to discuss the cause of the issue and to determine the connection between variables. Quantitative data is suggested for this type of study. By determining the frequency and mean, the connection between variables are measured (Sekaran, 2003:124–125).

Descriptive studies are conducted to describe the features of the variables found in the study. Qualitative and quantitative study methods are necessary for descriptive studies. The objective of descriptive studies is to provide clear characteristic behaviours of the subject being studied. First, the research problem is understood by analysing qualitative data obtained from interviews, and then quantitative data is obtained to get the statistics for the research problem (Sekaran, 2003:121 & 123).

Exploratory studies are conducted when there is limited or no data about a research topic. In addition, exploratory studies are conducted to expand the understanding of the research problem. Qualitative methods are used for exploratory studies and data is obtained through detailed interviews and observations (Sekaran, 2003:119–120).

This study used a qualitative descriptive study to discuss the advantages and disadvantages of using VR as an educational tool in developing countries in Africa.

2.2.3 Method of Reasoning

The method of reasoning determines how a study will conclude on data collected and analysed (Zalaghi & Khazaei, 2016:23). The following three methods of reasoning can be adopted by a study:

- Abductive reasoning is suitable when the investigator is making specific observations that are later described in a meaningful way (Shank, 2006).

- Deductive reasoning starts with a theory that is tested by gathering data. The results are afterwards analysed to confirm or refute the theory on the observed phenomenon (Msweli, 2011:32).

- Inductive reasoning commences with precise observations and outcomes to produce a theory from the data patterns that arise (Patton, 2015:64).

The present research falls within the ambit of inductive reasoning since it concluded on a theory that were formulated from research findings. The theory is that VR is effective as an educational tool in developing countries.

2.2.4 Time Horizon

The time horizon of a study is defined as the time taken to study the phenomenon to address the research question and to complete the study by drawing a conclusion on the findings of the research (Levin, 2014:20).

The time horizon of a study can be categorised into the following two types:

- Longitudinal studies: These studies entail investigating quantitative and qualitative information to reach conclusions about the topic under research over periods in time (Ployhart & Vandenberg, 2010:94).

- Cross-sectional study: These studies entail collecting data just once. The data is inspected at one point in time only, providing a snapshot view (Booth *et al.*, 2016:150).

The present study falls within the ambit of a cross-sectional study because the data collected for the study was collected at one point in time.

2.2.5 Unit of Analysis

A unit of analysis constitutes the phenomenon of the research and determines the type of data to be collected (Patton, 2015:260). Some examples of units of analysis are countries, individuals, projects, time periods such as academic semesters, rainy seasons, and days of the week, crime reports, and literature on a specific topic and programmes (Patton, 2015:261).

The unit of analysis for this study comprised of countries where VR as an educational tool is analysed for countries with the best ranked universities in the world to recommend for or against the use of VR in education in developing countries.

2.2.6 Nature of Data

The source of data is the type of data used in the study (Bacon-Shone, 2016:13). There are the following two categories of data:

- Primary data: This is original data that is collected for the very first time for a specific study (Johnston, 2014:620).
- Secondary data: This is data that is collected from already existing sources, such as previous studies done on the specific study (Johnston, 2014:619).

The process of collecting primary data is costly and time consuming, and the benefits of using secondary data are that it saves time and is cost efficient. The weakness of secondary data is that information may become dated and irrelevant to the current study, while primary data is suitable and up to date (Sekaran, 2003:223).

The study used secondary data. The data was collected from literature reviews and is qualitative in nature. The literature was obtained from academic articles, journals, conference papers, research papers, books and reports relating to the study. This data collection technique was the most appropriate and time efficient method for the current study because of the time limitation and the vast amount of literature already available on the topic.

2.3 METHODOLOGICAL CLASSIFICATION

The main methodological categories for research are quantitative research, qualitative research, and mixed methods research. Qualitative research translates and aims to define, interpret, or explain certain phenomena (Welman, Kruger & Mitchell, 2005:188). On the other hand, quantitative research views the facts objectively and in a non-biased manner by using numerical data (Welman *et al.*, 2005:188). According to Bhat (2020), qualitative research requires the full analysis of data since non-numeric data is used that assists in the thought process and in how conclusions are reached.

The ambit of this study falls within qualitative research, and a systematic literature review was used as the research approach.

2.3.1 Systematic Literature Review

A systematic literature review is the examination of the research area using a focused question that joins, characterises, and studies the proof that points to the aim of the study (Hastak, Khallaf & Naderpajouh, 2017). Systematic reviews are the most commonly used method of literature reviews and is intended to systematically search for research evidence. Systematic reviews allow researchers to duplicate the process of searching for research data, allowing for transparency (Grant & Booth, 2009:102). A systematic literature review entails four steps. The first step is the formulation of the research question, and this study asked the following question: What are the advantages and disadvantages of using VR as an educational tool in developing countries? The research question served as the compass to obtain relevant literature that addresses the research question.

Once the research question was formulated, the second step was to develop criteria in an attempt to answer the research question. This step involved establishing the inclusion and exclusion criteria using the research question as guidance. This study used criteria to obtain literature that addressed the following research objectives:

- To identify the reasons for the implementation of VR in tax education by analysing a sample of developed countries with the best ranked education systems;
- To compare the benefits and challenges of VR in tax education based on literature;
- To analyse the barriers hindering developing countries' implementation of VR as an enhancing tool for tax education; and
- To understand whether implementing VR in developing countries as a tool to enhance tax education is a sustainable solution.

The inclusion and exclusion criteria for the literature used in this study are discussed in detail in section 2.4.2.

The third step was obtaining literature using keywords in different databases and then to assess the quality of the data sources. This process involved identifying keywords relevant to the study and ensuring the reliability of the sources. The articles were obtained from the University of Pretoria library databases. These keywords are explained in detail in section 2.4.3.

Finally, the literature that met the criteria to be included in the study was synthesised. The literature that met the inclusion criteria was systematically sorted and then analysed.

2.4 IDENTIFICATION AND RECORDING OF ACADEMIC LITERATURE

Literature items were identified through a combination of inclusion and exclusion criteria, keywords, and databases. The relevance of each recognised article to the study was determined on the foundation of the abstract provided at the introduction of the article or journal. If it was unclear from the abstract of an article whether it was relevant to the research, it was still included in the downloaded batch and subsequently read at a high level to conclude whether it should be included or excluded. Literature and databases where there were no abstract were reviewed at a high level on a per item basis and included or excluded from further analysis based on the relevance determined at that stage of the literature review.

The identified literature was uploaded onto the Qiqqa software program for quality assessment and further analysis. The literature used in this study was limited to journal articles. Seventy-six (76) articles were obtained for this study, and keywords (discussed in section 2.4.3) were used on various scholarly databases to generate articles. These articles were then screened using specific inclusion and exclusion criteria to ensure that only literature relevant to answering the research question was included.

2.4.1 Data Collection Technique

Secondary, qualitative data was collected by searching scholarly databases provided by the University of Pretoria. ProQuest and EBSCOHost were selected as databases for this study. The databases generated peer-reviewed journal articles that were used for the literature review in this study. These articles were selected as these databases are ranked as the most popular scholarly databases by the University of Pretoria library website in terms of reliability of information generated to ensure that the research was obtained from reliable data sources. The search criteria were derived from the title of the study, the research question and the research objectives. This search criteria are further explained the following section.

2.4.2 Inclusion and Exclusion Criteria

The published articles were scrutinised to exclude irrelevant literature that did not add to the body of knowledge before being included in the literature to be investigated. These articles were screened using precise inclusion criteria based on the title of the study, the research question and the research objectives. The following inclusion criteria guaranteed that specific articles were included:

- Year: As far as possible only the most recent studies (published in the 21st century) on VR in education were included.
- Country: Studies on VR in education in developing countries with the 10 best ranked education systems in Africa (THE, 2021) were included to ensure that VR in developing countries pertaining to Africa were included in order to answer the research question.
- Construct: Studies that focused mainly on VR in education in developed countries with the 10 best ranked education systems in the world (THE, 2021) were included to ensure that the literature answered the research question and met the study objectives.

Exclusion criteria was used to guarantee that only relevant literature was included in the study to gain the best possible results and to screen literature that did not add to the central purpose of this study. This following exclusion criteria were used:

- Year: Studies focused on VR in education published before the 21st century would not add value and were excluded. This was done to ensure that outdated articles did not form part of this study.
- Country: Research on VR in education pertaining to developing countries outside of Africa were excluded as this research focuses on African countries.
- Construct: Studies not closely related to VR in education, such as those focusing on the role of e-learning in education, were not considered.
- Literature type: Studies that were not documented in the form of journal articles were excluded.

2.4.3 Keywords

In additional to using the inclusion and exclusion criteria, keywords were used to find relevant articles. Table 1 shows the combinations of keywords used.

Table 1: Keywords

Initial topic	Similar terms	Broader terms	Narrower terms
Virtual Reality as tax education tool in developing countries	Immersive virtual reality Augmented reality	"First life" virtual world in education "Second Life" virtual world in education VR used in best education systems	Virtual reality in South Africa Virtual reality in Africa Virtual reality in developing countries Tax education

The keywords contained in Table 1 were used simultaneously to conduct the search. Column 1 is the topic of the study from which similar terms (column 2) stemmed from. The phrases 'immersive virtual reality' and 'augmented reality' were used synonymously in the search. This enabled the search to be expanded and include articles with any one of those phrases as the topic of discussion.

Column 3 (broader terms) provided the link between virtual reality and education to enable the research question to be answered, as the articles needed to include a link of virtual reality and education. Column 4 (narrower terms) allowed the search to be expanded as virtual reality and education did not address the research question, which focuses on developing countries. Narrower terms were thus different components of an education system in Africa that enabled the search to be expanded. In this way, articles relating to developing countries in Africa were also generated by the search.

2.4.4 Summary of Analysed Literature

A process of elimination was used to filter and select the seventy-six (76) articles that constituted the literature analysed for this study. Figure 1 illustrates this process of elimination.
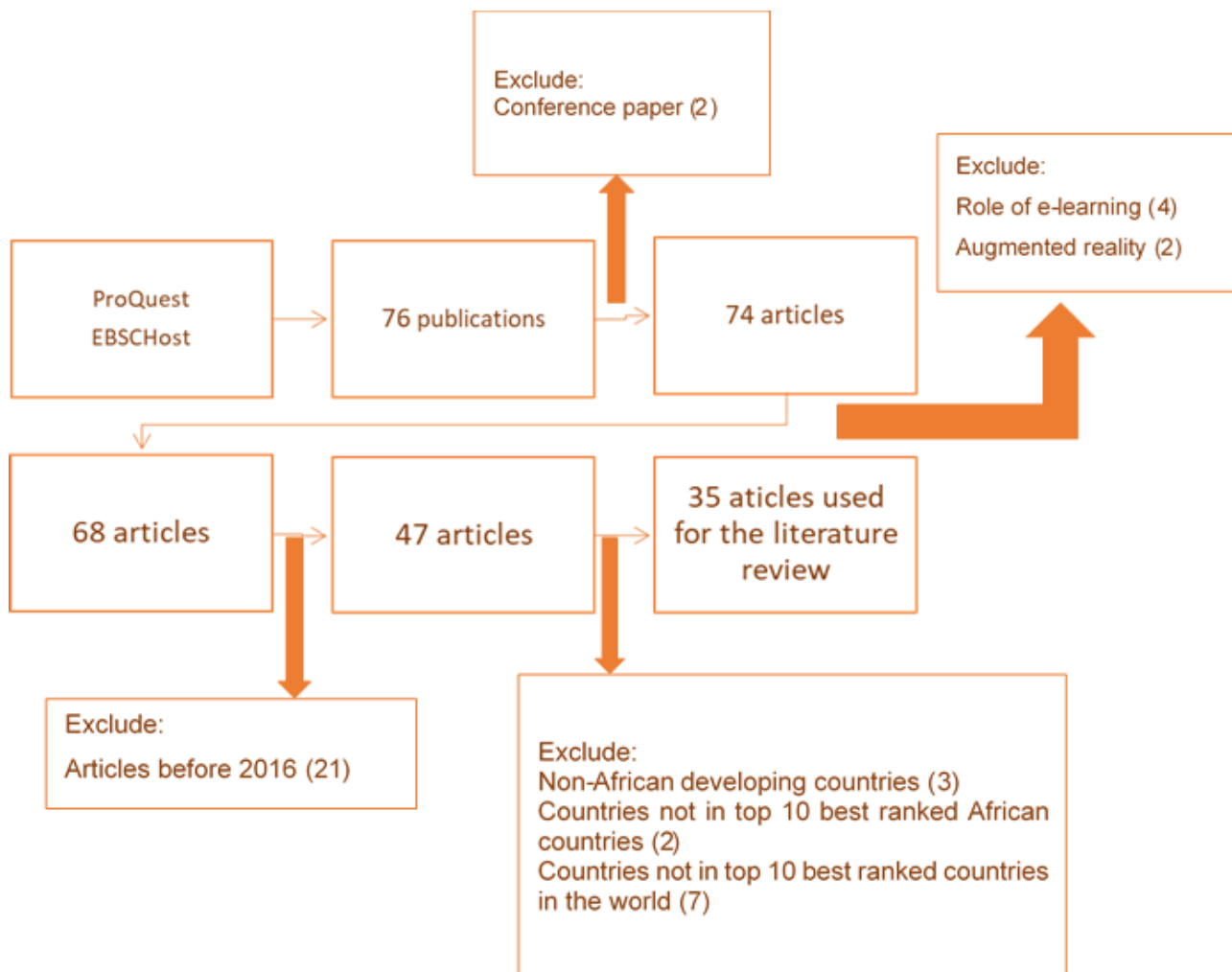
Figure 1: Summary of analysed literature

Figure 1 shows that 76 articles were obtained from the initial search on the EBSCOhost and ProQuest databases. The initial search used the keywords described in section 2.4.3, mainly encapsulating VR in education. To filter the 76 publications, all articles that were not journal articles, such as 2 conference papers, were excluded. The conference papers were excluded as it constitutes grey literature, which is not deemed credible. After excluding the conference papers, 72 journal articles remained.

In order to focus the literature to this study, the journal articles were filtered according to the titles of the journal articles. All articles where the titles included role of e-learning and augmented reality were excluded in order to remain with articles relevant to answering the research question. Further, to ensure that outdated data was excluded, only journal articles that included VR in education since 2016 were included, ensuring that current data on VR in education that are still in place were analysed. Lastly, to ensure that the literature is specific to developing countries in Africa, studies on VR in education implemented in

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non-African developing countries were excluded; this enabled a meaningful analysis of literature on VR in education in developing African countries. Studies on VR in education in developing countries in Africa that is not among the top 10 best ranked universities in Africa were excluded. This enabled the study to focus on best practices for developing countries in Africa. Furthermore, countries not in top ten best ranked countries in the world were also excluded to remain with the best practices in the world.

The process of obtaining the 35 articles that constitute the analysed literature was therefore very thorough and ascertained that only relevant and credible journal articles remained to be analysed in order to answer the research question.

2.5   DISCUSSION OF REVIEWED LITERATURE

When exploring the possibility to implement VR as an enhancing tool in tax education in developing countries, it is important to review literature on VR in education together with the nature of the tax profession (i.e., the set of skills a tax expert is supposed to have) and literature on tax education curriculums. Curriculum developers should incorporate the digital era when designing syllabuses as it is important to highlight the growth of the individual as a whole and not just their educational skills (UNESCO, 2020).

2.5.1 Virtual Reality in Africa

The most common explanation for VR is a 3D computer-generated environment that the user can direct and interact with, leading to real-time simulation of one or more of the user's five senses (Burdea & Coiffet, 2003; Gutierrez, Vexo, & Thalmann, 2008; Guttentag, 2010). VR has a footprint in African education systems, despite most of the countries being classified as developing countries, who are facing the challenge of acquiring digital equipment (Dube & Scott, 2017). Africa is not known for using artificial intelligence (AI), especially in education, yet VR in education has been explored.

Jantjies, Moodley and Maart (2018) looked at experiential learning through virtual and augmented reality in dentistry in higher education. They found that the use of VR technology shows an academic ability for deep learning in students and allows for an increased opportunity for work integrated learning. A longitudinal study of students' perceptions of immersive virtual reality teaching interventions found that students

perceived the VR teaching mediation as prodigiously optimistic and as an instrument that can improve their understanding of the principles of taxation (Du Preez & Hill, 2021).

Several other studies investigated the use of VR in education at tertiary institutions in developing countries in Africa and suggest that VR in education yielded positive results (Gbaje, 2007; Omieno, Wabwoba & Matoke, 2013; Osuagwu, Ihedigbo & Ndigwe, 2015). These positive results are described as virtual learning systems, showing that VR can be used in virtually all areas of study and that it will encourage innovation and provide education excellence (Omieno *et al.*, 2013). The integration of VR into traditional instructional designs is likely to add value to the educational experience of students by bridging the gap between technical skills and theory, developing employable graduates (Osuagwu *et al.*, 2015). One mechanism suggested for VR integration in education is through the process of building a virtual reality library that provides access to VR equipment and assist in enhancing teaching excellence (Gbaje, 2007). Onyesolu (2009) state that there are challenges for science and technology studies, and the most common hurdle for science and technology studies in developing countries is the lack of equipped laboratories. It is suggested that the application of VR in laboratories would overcome this barrier by providing a 3D computer-generated environment where a user can explore and engage in a real-time simulation of one of a user's five senses. Augmented reality and VR has the potential to support personal and clinical change in humans. VR can change our internal capability by organising, changing, and/or substituting our physical uneasiness (Riva, Banos, Botella, Mantovani & Gaggioli, 2016).

VR in education has also been explored in primary and secondary schools in developing countries in Africa and the perception of children were positive as they embraced the use of VR in education the classroom (Onapito & Bainomugisha, 2015). VR provides an interactive and engaging experience to children in primary schools (Onapito & Bainomugisha, 2015). In another study, learners and teachers in both private and public schools expressed appreciation for virtual learning and suggested that the mechanisms used during the lockdown crises to reach learners have more added advantages that can be used in future (Mataka, Mukurunge & Bhila, 2020). This study's review of the literature makes it clear that in the last decade, VR in education has been accepted by learners and students in African countries such as Nigeria, Rwanda, Kenya, Zimbabwe, and Uganda. However, according to a UNESCO report in 2002, some of the drawbacks of VR in Africa is attributable to equity, accessibility, and the cost of developing content for Africa.

Another challenge faced by some universities in developing countries in Africa is the massification of classes where education facilitators are unable to interact with everyone in the classroom, and this requires alternative and creative teaching techniques in a creative space (Pillay, 2020). Some of the challenges, such as accessibility and the cost attributable to VR equipment, used to hinder the use of VR as an educational tool. However, VR in education has expanded since the cost of VR equipment decreased globally because of technological advancements since 2016 (Yasai, Kawai & Arakawa, 2019).

2.5.2 Virtual Reality used Globally

The use of VR in education in developed countries with some of the best education systems is quite common and there is enough available data to explore. VR has been used in a practical set-up in the USA to collect data using a virtual reality environment (Bornmann, Creekmore & Bergen-Hill, 2012). The facts on respondents' tax choices were collected through virtual games that provided researchers with an instrument to perform sound tests and adjust the game play variables. The instrument was then used to determine the situations under which tax filing mistakes, intentional and unintentional, are likely to transpire (Bornmann *et al.*, 2012). VR has also been used as a teaching and learning tool in education studies in Australia where students could experience new learning prospects through digital augmentations, such as bringing a historical character to life in the lecture hall or generating a virtual classroom where the same individual attention is provided from the teacher. Currently different types of VR equipment are globally available, and it is more easily accessible in developed countries (Cooper *et al.,* 2019).

The use of VR in education in developed countries is more common, and one way in which VR in education is used to enhance students' learning experiences in a virtual classroom is by using VR headsets to expose students to a computer-generated environment that can be interacted with in supposedly real or physical ways with fully realistic images, sounds, and other sensations simulating users' physical presence in those environments (Farshid *et al.*, 2018). The willingness of respondents to use VR in a classroom in Australia were accessed and approximately 97% of the students in the sample indicated a high level of interest in using VR in classrooms (Cooper *et al.*, 2019). Another study suggest a mobile game application called Conserv-AR to increase awareness and knowledge surrounding environmental conservation in Western Australia (Phipps, Alvarez, de Freitas,

Wong, Baker & Pettit., 2016). Research done in Ireland found that both contemporary and asynchronous online learning options are available to participants and that VR enhances group work (Page, Thorsteinsson & Niculescu, 2008). These asynchronous learning alternatives provides for different learning styles. According to Barbe, Milone & Swassing (1988), there are three types of learning styles, namely visual, auditory, and kinaesthetic. The application of VR in education allows for all three of these learning styles to be targeted in one application; however, VR is not necessarily equally suitable for all subject areas (Allcoat & von Mühlenen, 2018). However, Lowell and Morris (2019) suggested that adult learners may not be as comfortable or acquainted with the use of technology and may not be adequately informed on how to use it. That means that the use of VR for these users will potentially create an obstacle to their capability to comprehend and complete content using this technology. Filer and Holmes (2018) suggests that VR technology has been beneficial to support the learning content for taxation and that students recommended its further use.

2.5.3 Curriculum Development for Tax Graduates

When developing a curriculum for any educational course at tertiary level, one component that must be considered is the graduate outputs required and the key competencies that graduates should possess once they graduate from tertiary education. The South African Institute of Tax Professionals (2021) indicates that tax professionals should possess adequate computing and information communication technology skills. These skills are also listed by them as an added advantage to compete for employment in a tax related position. VR in tax education can possibly be used to cultivate these information communication technology skills in tax professionals. Furthermore, an individual's success within the accounting profession is linked to certain personality traits and social skills (Satava, 1996; Schloemer & Schloemer, 1997; Siegel, Smith & Mosca, 2001). It can be concluded that a tax professional falls within the framework of the accounting profession as it is in several aspects similar to the accounting profession, and therefore, it becomes equally important that soft skills such as good communication and teamwork be encouraged during an individual's education journey. VR as a teaching tool allow students to interact with their peers (small groups) and the facilitator by creating a more conducive environment for engagement compared with traditional face-to-face environments. Tax professionals who are self-assured, confident, pensive, and informed about tax related

matters are also the individuals who communicate a greater amount of useable knowledge to the client (Michaelsen & Nichols, 1999).

2.6 CONCLUSION

The research design of the present study followed a pragmatic approach, is descriptive in nature, and supports inductive reasoning. The study is cross-sectional and focuses on VR as a tax educational tool for developing countries. Secondary, qualitative data were gathered using keywords and inclusion and exclusion criteria. The methodology of the study was qualitative, and it used a systematised review. Lastly, this chapter provided a high-level summary for the literature reviewed on VR in education in developing countries in Africa, developed countries and the curriculum requirements for tax graduates.

CHAPTER 3
DATA ANALYSIS AND PRESENTATION OF RESULTS

3.1   INTRODUCTION

The main purpose of this study was to explore academic articles related to VR as a tax educational tool in developing countries. After applying the keywords and inclusion and exclusion criteria to the databases, 35 articles were obtained and analysed. The general analysis aims to elaborate on the analysis performed on the 35 articles that constitute the literature of the research and to explain the findings of the analysis based on general elements of analysis used. It further explains the data analysis technique used, presents the results, and elaborates on the findings from this analysis using the research sub-questions and then provides an overview for research ethics.

3.2   DATA ANALYSIS PERFORMED ON ARTICLES

To analyse the existing literature on the use of VR in education in developing countries several data analysis techniques such as thematic, diagnostic, predictive, prescriptive, and statistical techniques were considered. The thematic analysis technique aims to identify the patterns and trends within the collected data (Vithal, 2010:68) as well as detects patterns and themes associated with the phenomenon investigated (Swain, 2018). Diagnostic analysis is aimed at answering the 'why' question by determining the reason or cause of the research problem. Predictive analysis focuses on the predicted outcomes based on current or past data. Prescriptive analysis focuses on an action plan based on current data and may use interpretations derived from all other data analysis techniques (Krishna, 2020).

The objective of statistical data analysis is to answer the 'what' question. It is associated with quantitative research and includes descriptive and inferential analysis. When numerical data is analysed to provide perpetual conclusions it is known as descriptive analysis, whereas inferential analysis reaches different conclusions from the same data when dissimilar samples are chosen.

The ambit of this study falls within the thematic data analysis technique with an *a priori* theme arrangement. This technique was used because certain pre-determined themes (i.e. *a priori* themes) as well as specific paradigms associated with VR in education were

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identified. These pre-determined themes and patterns are the relationship between VR and education, the advantages and disadvantages associated with it, as well as the sustainability of the use of VR in education in developing countries.

3.3 PRESENTATION AND DISCUSSION OF FINDINGS

This section presents and discusses the results of the analysis from the selected quality academic articles. It provides an overview on how the results were obtained by explaining the process and databases consulted to reach the findings.

3.3.1 Academic Journals

The outline of the journals in which the selected academic articles were published as well as the academic disciplines to which these articles belong are analysed in this section.

3.3.1.1 *Journals*

The selected academic articles were published in a number of academic journals. Table 2 presents a summary of these journals.

Table 2: Academic journals

Academic journal	Number of articles
Asia Pacific Institute of Advanced Research	1
Australian Journal of Management	1
Business Horizons	1
Computers & Education Journal	1
Current Issues in Tourism	1
Educational Media International Journal	1
Global Journal of Engineering Sciences	1
The Ohio State Technology Law Journal	1
IAFOR Journal of Education	1
Institute of Electrical and Electronics Engineers (IEEE)	2
International Journal of All Research Writings	1
International Journal of Emerging Technologies in Learning	2
International Journal of Science and Research	1
IOSR Journal of Nursing and Health Science	1
Journal of Clinical Gerontologist	1
Journal of International Affairs Editorial Board	1

Academic journal	Number of articles
Journal of Journalism Studies	1
Journal of Open Innovation and Technology, market and complexity	1
Journal of Virtual Worlds Research	1
Learning and instruction Journal	1
Nationaal Regieorgaan	1
The International Journal of Information and Learning Technology	3
Other (books, mini-thesis research papers, conference papers, etc.)	9
Total	**35**

Most of the articles were published in various renowned academic journals, as seen in Table 2. This means that most of the data were obtained from credible sources; however, literature in the form of books, conference papers and mini-thesis research papers from research students was also selected for further analysis in this study. These resources are regarded as credible as they have been peer reviewed.

3.3.1.2 *Academic disciplines*

A discipline can be commonly defined as a subject taught. The definition can be expanded to include a body of accumulated expertise knowledge on a subject identified in an academic institution (Vithal, 2010:22).

The discipline element showcased how much attention has been given to the subject of VR in education. The main academic disciplines to which the selected articles belong to are illustrated in Figure 2.
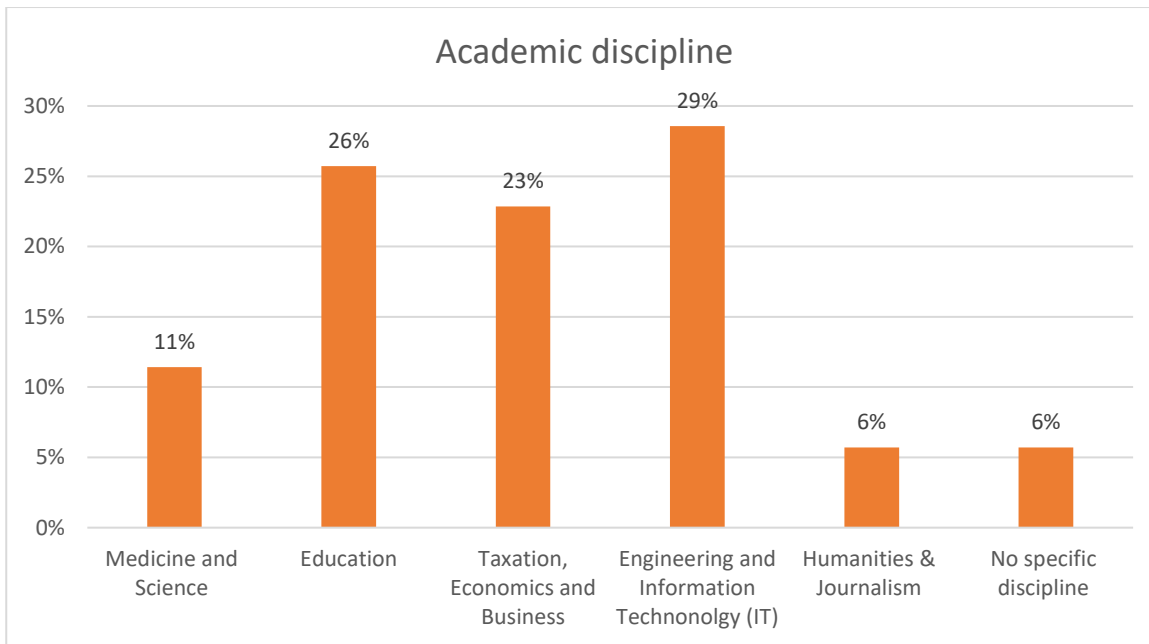
Figure 2: Academic disciplines

The breakdown of academic disciplines denotes the importance of the research area as well the number of major disciplines that have focused their attention on VR in education.

The selected academic articles are categorised into academic disciplines, such as medicine and science; education; taxation, economics and business; engineering and information technology; and humanities and journalism. A few articles could not be placed in any specific discipline. Most of the articles analysed fall in the engineering and information technology discipline, followed by education and taxation, economics and business. This indicates that the area of research is still very compelling to a vast number of academics and researchers across disciplines, especially within the engineering and information technology discipline. This is not surprising as VR is part of digital technology that deals primarily with information technology and the engineering environment and would therefore in general fall in this discipline. Furthermore, the various disciplines in which the literature were found also indicate that there is significant interest in VR in education and that more studies are likely to be conducted in this field across disciplines.

3.3.2 Perspective

This section looks at the perspective from which the studies in the selected articles were done, specifically the country and whether the countries are developed or developing countries.

3.3.2.1 *Country perspective*

For the purposes of this study, the country perspective was defined as the country for which the study was done. The academic articles were individually analysed to determine the country perspective of each article. Table 3 shows the countries for which articles could be found, and Figure 3 shows the category (i.e., developed or developing) in which the country falls. For purposes of this study, developed and developing country was classified according to its economic and social status.

Table 3: Country perspective

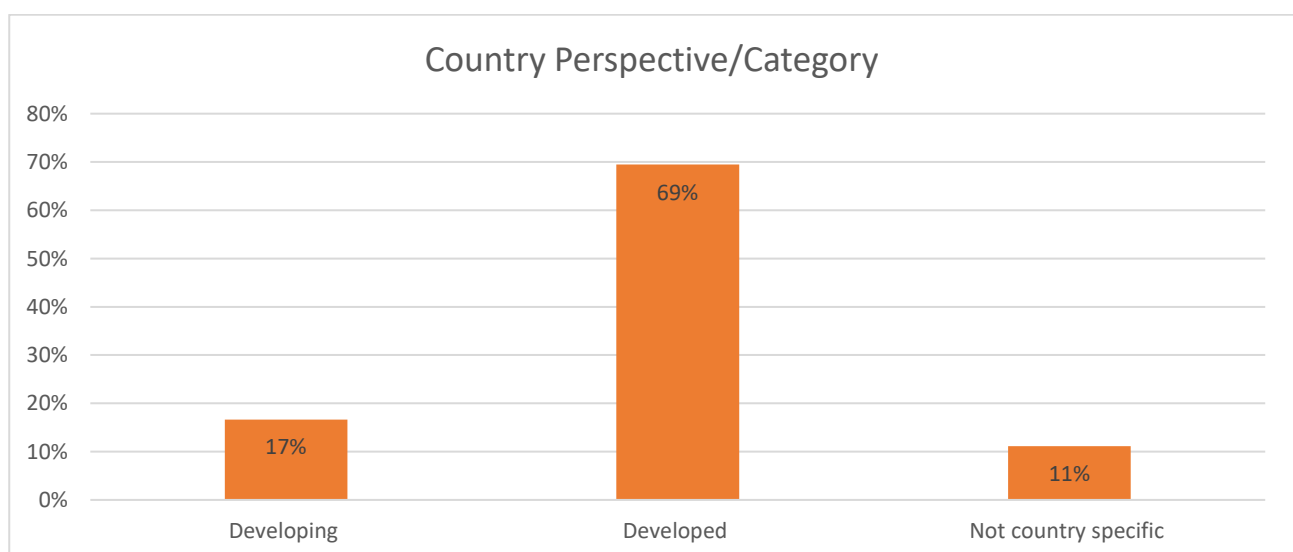| Country	Number of articles
UK (Scotland, England, Wales and Northern Ireland)	5
USA	11
Germany	4
Australia	4
Netherlands	1
South Africa	2
Nigeria	1
Morocco	1
Zimbabwe	2
No specific country	4
Total	**35**

Figure 3: Country category

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The country perspective (Table 3) relates to the country for which the study was conducted. The results provide an overview of the specific region, if any, where VR in education was studied. From Figure 3 it is evident that sixty-nine percent (69%) of the articles were written from a developed country perspective, such as the UK, the USA, Germany, Australia, and the Netherlands, and that seventeen percent (17%) of the articles originated in developing countries such as South Africa, Nigeria, Morocco and Zimbabwe. Eleven percent (11%) of the selected academic articles do not focus on a specific country but examine VR in education at a universal level. This global relevancy of VR in education is an indication that it is not restricted to specific countries or regions. Furthermore, the results indicate that VR in education is not only studied in developed countries where there is a presence of AI and robotics, but that developing countries explore VR in education despite the challenges of acquiring the digital equipment. It clearly shows the universality of VR in education and that its significance is recognised by both developed and developing countries worldwide.

3.3.3 Theoretical Framework

The theory that clarifies why the investigated research problem exists is referred to as a theoretical research framework. This section examines the constructs as part of the theoretical framework for this study. A construct is defined as the subject, fundamental theme or main idea researched in a study (Vithal, 2010:25). In order to gain an understanding of the ground that has been covered in the research area of VR in education, the constructs in all the articles were considered. This provided an overview of the aspects of VR in education that have already been extensively researched and those that have not been researched.

3.3.3.1 *Main constructs under review*

The main constructs covered by the selected academic articles are the benefits of VR in education, the disadvantages of VR in education, barriers hindering the implementation of VR, the sustainability of VR in education, curriculum or professional skills required, and the VR equipment and technology available. These are summarised in Table 4. More than one construct may be visible in an article.

Table 4: Constructs

	For VR in education	Disadvantages of VR in education	Barriers for VR in education	Sustainability of VR	Professional skills required	VR technologies available
Number of articles	23	13	14	12	3	9

Lavrakas (2008) define a construct as an abstract idea or underlying theme that can be quantified directly or indirectly by assessing key indicators. As a result, the main constructs in this study include the arguments for and against VR in education, barriers and sustainability of VR, professional skills required by graduates and the VR technologies available. The findings indicate that more than half the articles, sixty-six percent (66%) argue for the implementation of VR in education and focus mainly on its benefits. There are, however, studies that are critical of the implementation of VR in education and elaborate on its disadvantages or barriers hindering instructors to implement VR in education. A number of articles indicate that the implementation of VR in education might be sustainable. Lastly, the professional skills or curriculum requirements and the availability of VR technologies have not received as much attention as one would expect given that these two elements are more important than the others to determine whether or not a country will consider the implementation of VR in education.

The selected articles that primarily discuss the benefits of VR in education highlight a few prominent advantages. These include access to VR continues to become cheaper; it allows students to better understand abstract concepts; it allows logical walkthroughs by immersing a user into an environment without ever visiting a site in person; and participants displayed an improved learning experience and improved memory function. Thirty-seven percent (37%) of the articles focusses on the disadvantages of VR in education. The main disadvantages associated with VR are that despite VR becoming cheaper in recent years, the cost to acquire high-end computer hardware is still considered high; the possibility of VR sickness (or cybersickness) in some users; VR equipment can be uncomfortable after a period of time; and instructors may have to update teaching materials regularly to keep up with rapidly changing technology.

Some of the selected articles elaborate on the barriers hindering the implementation of VR in education and the main barriers are equity and understandability for participants. The current available VR equipment are immersive technologies, such as Oculus, Vive, Samsung Gear, Google Cardboard, and Samsung Odyssey. The construct relating to the

professional skills requirement are linked to the 4IR, which is predicted to bring change relating to the skillset of the workforce.

The constructs were specifically incorporated into the study to adequately answer the research objectives. Hence, the result of the study leans stronger towards supporting the implementation of VR in education in developing countries.

3.3.4 Year of Publication

For the purposes of this study, the year of publication was defined as the year in which an article was published in the journal from which it was derived. The convenient sample technique was used to select the year of publication and provide an overview of the recent time periods that covered in the studies published on VR in education. Table 5 illustrates the years of publication of the journal articles.

Table 5: Year of publication

Year of publication	Number of publications
2021	2
2020	5
2019	13
2018	8
2017	4
2016	3
Total	35

The years of publication narrate the progression of the study field and its relevance. The fact that studies on VR in education have increased significantly in 2019 and continue to be done beyond seems promising as this indicates that researchers across disciplines believe in the potential of VR in education.

From 2016, the studies published that relate to VR in education gradually increased; this could possibly be linked to technological advancements during 2016 that allowed the cost of VR equipment to decrease when more affordable head mounted devices were introduced at a low cost (Yasai *et al.*, 2019). The reduction in cost expanded the use of VR applications to disciplines in which the use of VR had not previously been explored. The lower number of articles that met the criteria of the sample in 2020 is due to the Covid-19 pandemic, which caused a total disruption from the 'normal', causing the focus of research

to lean more towards virtual reality learning environments, which were specifically excluded for this study. The fact that there are publications from 2021 is indicative of the continued interest in research in VR in education.

3.3.5 Research Design and Methods

In this section the results of the research design and methodology outlined by the researchers in the sample of articles are applied. It includes the nature of the studies, the methodological classifications, the research strategies, the data collection techniques and the data analysis techniques.

3.3.5.1 *Nature of the data*

Figure 4 illustrates the nature of the data of the selected articles.
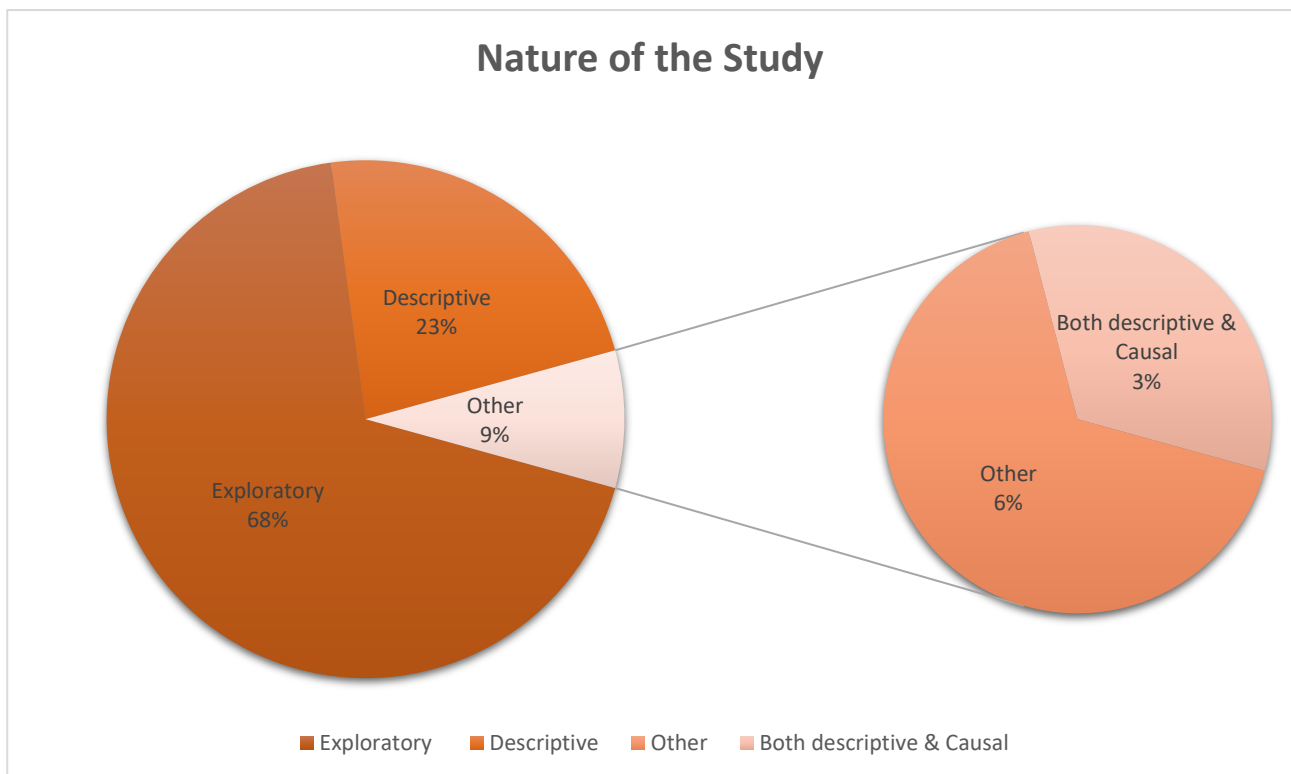
Figure 4: Nature of the data

Studies can be classified according to its nature as either causal, descriptive, or exploratory. The nature of a study is selected by considering what is known about the research topic and what the research aims to achieve (Sekaran, 2003:119).

Sixty-eight percent (68%) of the selected studies are exploratory in nature, twenty-two percent (22%) are descriptive in nature, three percent (3%) are a combination of

descriptive and causal, and a few studies, six percent (6%) do not belong to any of the categories as they are either books or newspaper publications. There is a high number of exploratory studies due to the 2016 technological advancements in VR equipment, making it more accessible and thus attracting more interest across disciplines. A reasonable number of the selected articles are descriptive studies because VR in education is not a completely new area of research.

3.3.5.2 *The Australian Business Deans Council list*

This study used the Australian Business Deans Council (ABDC) list to assess the quality of the data. The ABDC publishes this list of journals, rating them from A*, A, B, C to "not ranked". The ratings are attributed to the credibility of the content of articles published in that journal to give an assessment of the quality of the content of information published in the journal. This review of the quality of the journal is done every year to ensure that the journals are constantly rated for the quality of their article publications (Hirschberg & Lye, 2020).

The academic journals captured on Qiqqa were searched for on the ABDC list to verify the rating of the academic journal. The ratings indicate the reliability and quality of the content of the academic journals. An A* ranking represents the highest and best rank, meaning the journal is very reliable and has exceptional credentials; an A rank represents excellent credentials; a B rank represents good credentials; and a C rank represents satisfactory credentials.

Table 6 illustrates the ratings of all 35 journal articles that were analysed.

Table 6: ABDC list

Title of article	Publication date	A* rated	A rated	B rated	C rated	Not rated
Augmented reality for enhancing life science education	2019					x
Do students learn better when seated close to the teacher? A virtual classroom study considering individual levels of inattention and hyperactivity-impulsivity	2019		x			
Go boldly! Explore augmented reality (AR) virtual reality (VR), and mixed reality (MR) for business	2018		x			
Immersive process model exploration in virtual reality	2020		x			

Title of article	Publication date	A* rated	A rated	B rated	C rated	Not rated
Learning in virtual reality: Effects on performance, emotion and engagement	2018				x	
Learning to fall forward. A study of teacher courage, equity, and freedom in the connected learning classroom	2018				x	
Monitoring indicators of the flipped classroom learning process based on data mining—Taking the course of "virtual reality technology" as an example	2019			x		
Multigenerational classrooms in higher education: Equity and learning with technology	2018				x	
Older adults' experiences with audio visual virtual reality: Perceived usefulness and other factors influencing technology acceptance	2018					x
Virtual reality in education: Focus on the role of emotions and physiological reactivity	2019					x
Using virtual reality in the classroom: Preservice teachers' perceptions of its use as a teaching and learning tool	2019		x			
Virtual reality, 360° video, and journalism studies: Conceptual approaches to immersive technologies	2019					x
Virtual reality learning management system for classroom instructors	2019					x
Virtual and augmented reality applications for environmental science education and training	2020					x
A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda	2020			x		
Conserv-AR: A virtual and augmented reality mobile game to enhance students' awareness of wildlife conservation in Western Australia	2016					x
Immersive learning explored: Subjective and objective factors influencing learning outcomes in immersive educational virtual environments	2017				x	
A longitudinal study of students' perceptions of immersive virtual reality teaching interventions	2021					x
New realities: A systematic literature review on virtual reality and augmented reality in tourism research	2019		x			
E-learning in nursing education in Rwanda: Benefits and challenges. An exploration of participants' perspectives	2016					x
A survey of the university students' perspectives about using digital technologies in education: Zimbabwean case	2017			x		

Title of article	Publication date	A* rated	A rated	B rated	C rated	Not rated
Virtual teaching and learning: A sad reality of the 'haves' and 'have nots', the teacher's voice in Zimbabwe during Covid-19 pandemic	2020					x
Virtual reality & augmented reality in primary education	2017					x
Augmented reality and virtual reality in education. Myth or reality?	2019			x		
Virtual reality and distance education	2019				x	
Taxonomy of virtual and augmented reality applications in education	2021					x
Virtual reality for design and construction education environment	2019					x
Virtual reality	2017				x	
Using VR to increase student engagement and employability skills when teaching taxation	2018		x			
First Life, the neighbourhood social network: A collaborative environment for citizen	2016					x
Taxing dilemma: Robot taxes and the challenges of effective taxation of all, automation and robotics in the Fourth Industrial Revolution	2020					x
Gig work and the Fourth Industrial Revolution	2019		x			
How to respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic new combinations between technology, market, and society through open innovation	2018				x	
Navigating the Fourth Industrial Revolution: Taxing automation for fiscal sustainability	2019		x			
On robot revolution and taxation	2018					x
Total		0	7	5	7	16

From Table 6 it is apparent that of the 35 articles, seven articles, twenty percent (20%) has an A rating; five articles, fourteen percent (14%) has a B rating, and seven articles, twenty percent (20%) has a C rating. This means that information from those journals is highly ranked (excellent, good and satisfactory, respectively). Sixteen articles, constituting less than half of the articles, had no rating on the ABDC list. The rankings reflect the number of highly ranked scholarly journals that are focusing on a topic. Seven of the rated articles, twenty percent (20%) received an A rating and five, fourteen percent (14%) received a B rating, and this accumulates to at least one third of the selected studies being published in prestigious scholarly journals. This could indicate why the research area of VR in

education gained traction since 2016 in highly rated scholarly journals that are influential enough to draw the attention of academics to enable the implementation of VR in education in developing countries. Furthermore, the fact that more than half of the articles were listed on the ABDC list showed tremendous potential to attract the attention of the more influential and credible journals. The fact that forty six percent (46%) of the articles were not rated on the ABDC list indicates that the research is still progressing and has not yet been fully exhausted as it still makes its way up the scholarly journal ladder. The ABDC list is, however, is not exhaustive and does not take all journals into account. All the articles in the study are peer reviewed and credible.

3.3.5.3 *Methodological classification*

The methodological classification applied by the selected studies are populated in Figure 5.
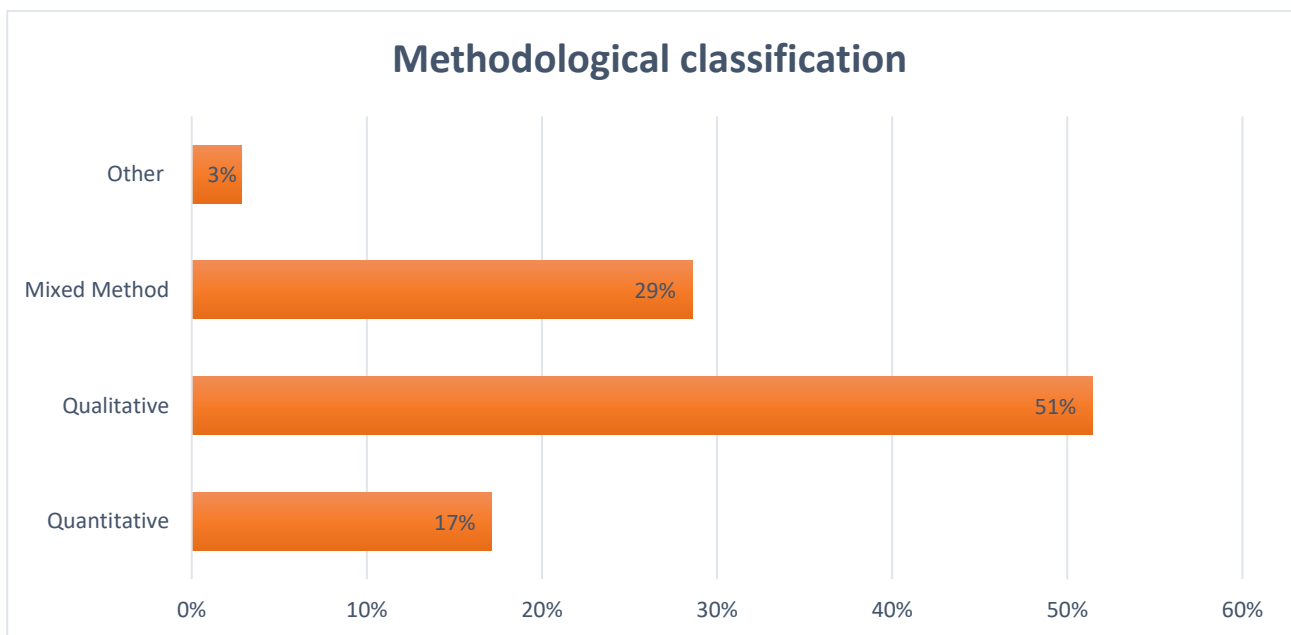
Figure 5: Methodological classification

Methodological classification aims to classify research as quantitative, qualitative or mixed methods. Quantitative studies are defined as objective and numerical in nature. Researchers view facts objectively, and the data obtained from quantitative research are objective, reliable and verifiable (Bhat, 2020). On the other hand, qualitative research uses non-numeric data that assists in the interpretation of phenomena and analyses how conclusions are reached (Bhat, 2020). Mixed methods research uses a combination of

quantitative and qualitative methods and is regarded as the most comprehensive form of research as it analyses both theoretical and numerical data (Creswell, 2014:32).

Fifty-one percent (51%) of the selected studies are qualitative, seventeen percent (17%) are classified as quantitative, and twenty nine percent (29%) are classified as mixed methods. Three percent (3%) of the studies do not fall into any of the categories as they are books or newspaper publications. The results of this study indicate that less quantitative data has been collected by researchers since 2016. The fifty one percent (51%) qualitative results indicate that the research area primarily leans towards documenting theoretical views. However, the fact that twenty-nine (29%) of the research falls in the mixed methods category is progressive as it means that a considerable amount of this study's results is derived from comprehensive research.

3.3.5.4 *Research strategies*

Figure 6 illustrates the research strategies adopted by the selected studies.
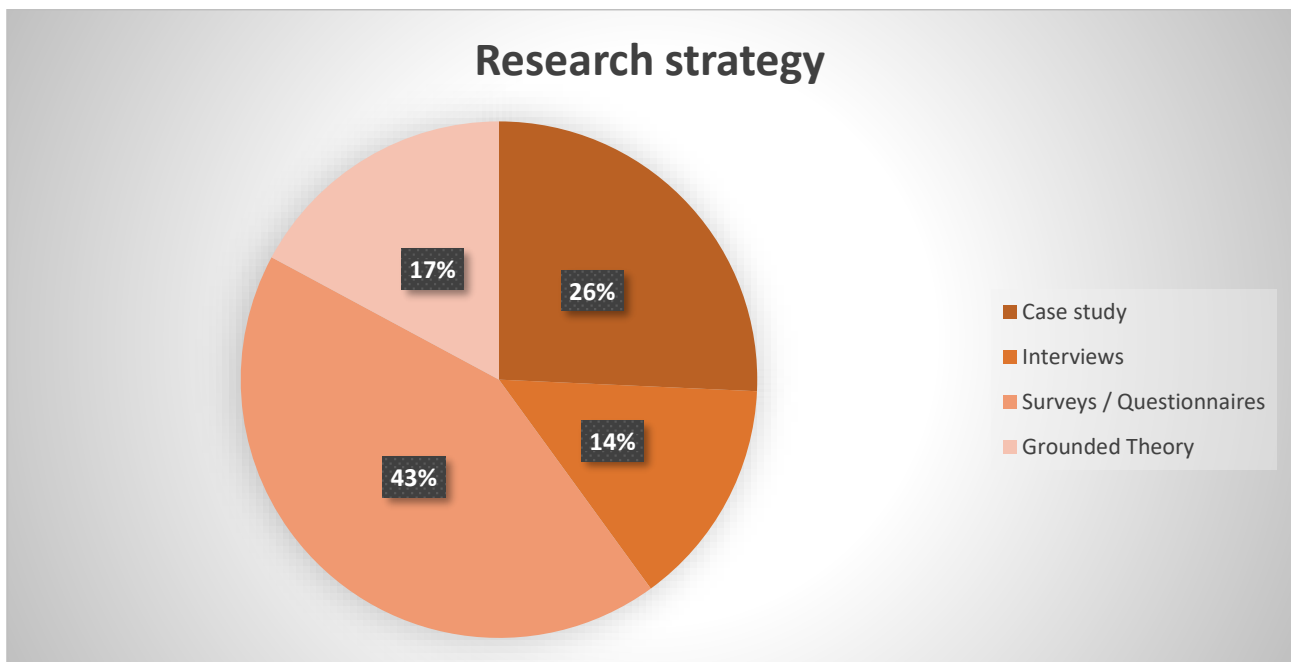
Figure 6: Research strategies

The results presented in Figure 6 indicate that case studies, interviews, surveys or questionnaires, and grounded theory were used by the researchers of the selected studies. The case study strategy was used in twenty six percent (26%) of the analysed literature, indicating that for 26% of the articles the studies focused on the specific countries or setting in question. The fact that seventeen percent (17%) relates to the

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grounded theory method and fourteen percent (14%) relates to interviews indicates that the selected articles predominantly used qualitative research, which is the most common data collection method and includes case studies and grounded theory.

3.3.5.5 *Data collection method*

The data collection techniques used in each of the selected studies are presented in Figure 7.
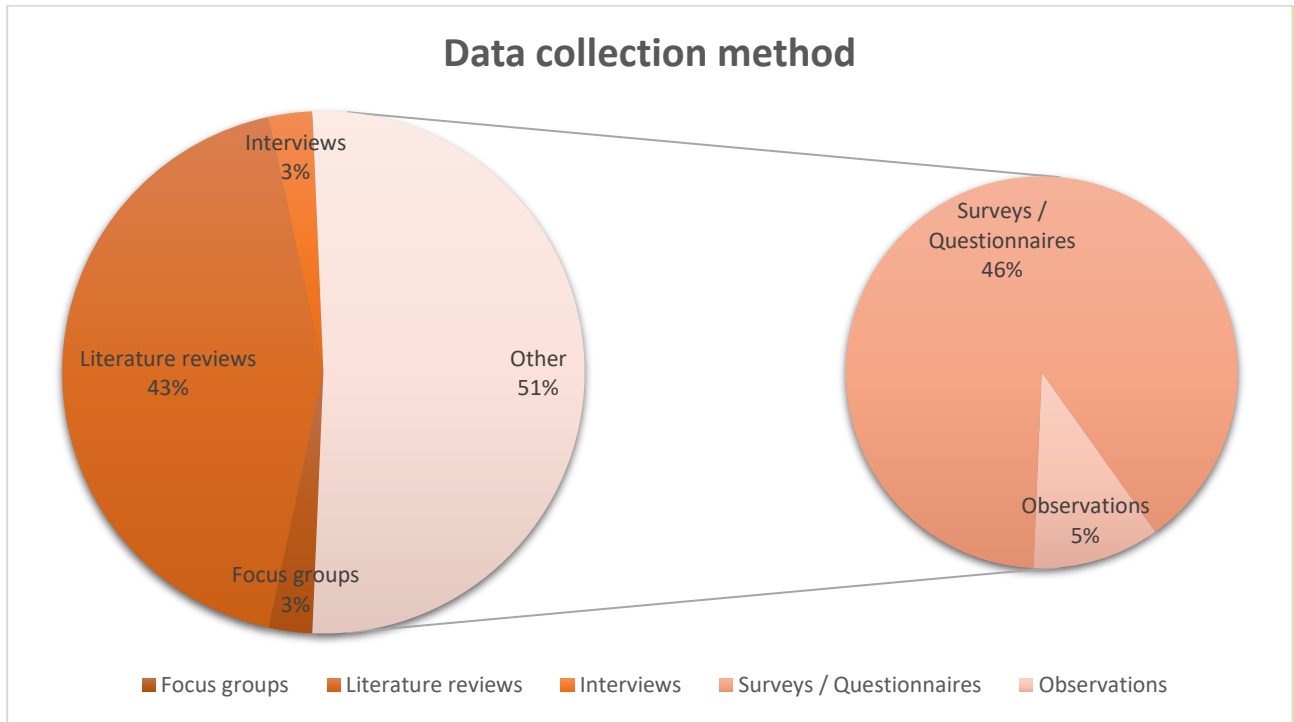
Figure 7: Data collection method

According to Figure 7, the research data were collected using methods such as literature reviews, interviews, surveys/questionnaires, focus groups or observations. At least forty three percent (43%) of the articles used literature reviews as the data collection method, and this indicates that the topic of VR in education is well described. The fact that fifty seven percent (57%) of the articles used interviews, focus groups, surveys or questionnaires and observation as data collection methods means that most of the data were collected from primary sources, which is sometimes regarded as more credible than secondary sources.

Most of the data for the selected academic articles were collected through literature reviews, indicating that the area of research has been extensively studied and that it is

improbable that a lack of literature will be a limitation to the study. The proportion of interviews, focus groups, observations, surveys, and questionnaires relates to data collection methods used by the respective academic articles under review and does not imply that this study used any of those methods. The high percentage, forty six percent (46%) of surveys and questionnaires used by the academic articles indicates that VR in education has gained considerable attention and has been extensively explored during the past five years.

3.3.5.6 *Data analysis technique*

The data analysis techniques used in each of the selected studies are illustrated in Table 7.

Table 7: Data analysis

	Quantitative		Qualitative			
	Descriptive	Inferential	Content	Narrative	Discourse	Grounded theory
Percentage of articles	11%	3%	49%	28%	3%	6%

The quantitative methods used in the selected studies are descriptive and inferential analysis. Descriptive analysis refers to the analysis of numerical data, whereas inferential analysis draws different conclusions from the same data with a different selection of data (Krishna, 2020). The results presented in Table 7 indicate that eleven percent (11%) of the studies done on VR in education described certain phenomena of VR in education (descriptive research). This provides the researcher with a background and understanding of VR in education globally.

The qualitative methods used in the selected studies are content, narrative, discourse and grounded theory. Most of the selected articles used content, forty nine percent (49%) and narrative, twenty eight percent (28%) data analysis because they are qualitative in nature and aimed to describe and establish themes to develop theories or models for VR in education.

3.3.5.7 *Type of data*

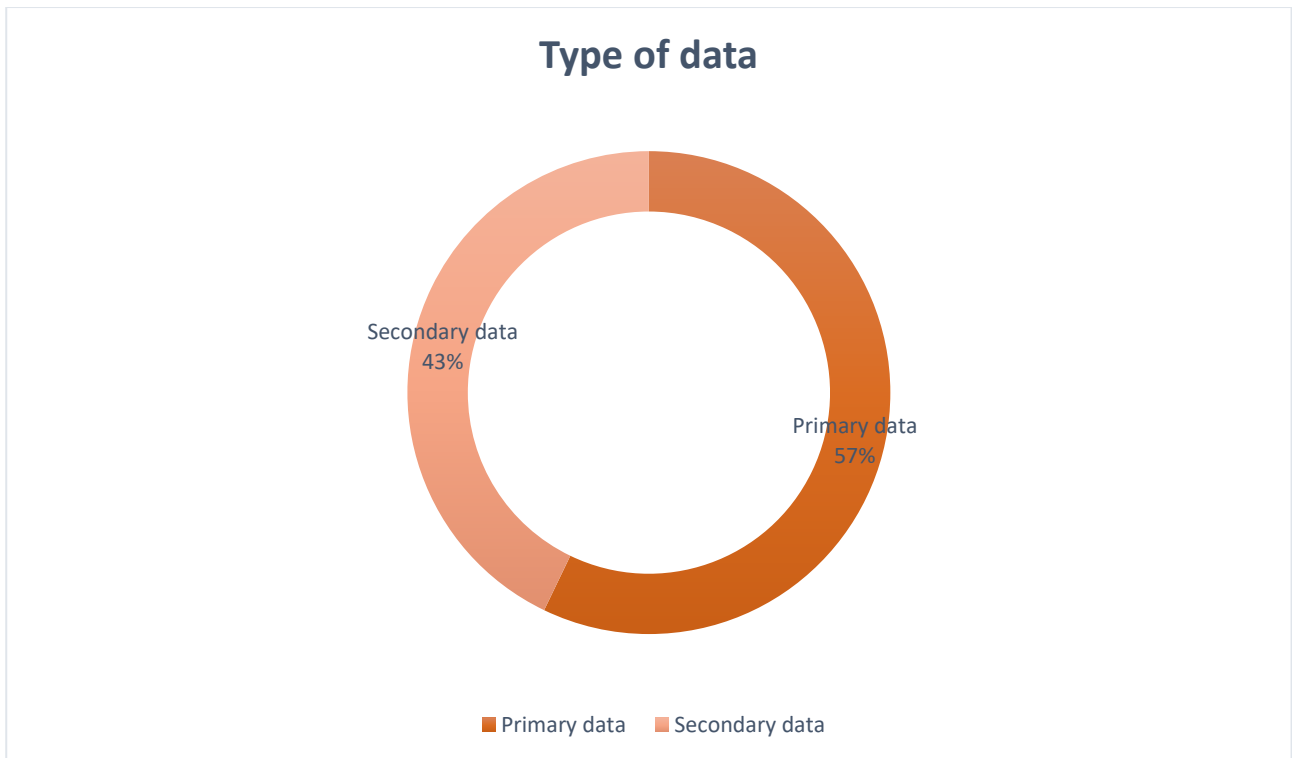Figure 8 illustrates the type of data used in the selected articles.

Figure 8: Type of data

The elements of primary or secondary data enabled the analysis of the nature of the data. Primary data is information that is collected for the very first time for a specific study (Johnston, 2014:620). Secondary data, on the other hand, is data that is collected from already existing sources, such as previous studies done on the topic (Johnston, 2014:619).

At least fifty seven percent (57%) of all the data used in the respective studies was obtained from primary sources such as interviews, surveys or questionnaires, observations and focus groups to obtain the data. Since a large portion of the studies were explorative in nature, it depicts that primary information was collected. Less than half of the data were obtained from secondary sources such as literature reviews. This indicated that, to answer the research question, most information would have to be gained from primary sources through studying prior studies.

3.4 ANALYSIS OF VIRTUAL REALTIY AS AN EDUCATIONAL TOOL FOR DEVELOPING COUNTRIES

The current research study sought to analyse the advantages and disadvantages of using VR as an educational tool implemented in developed and developing countries. In order to

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provide a comprehensive overview, the objective of the study had to be analysed. These objectives are reasons for the implementation of VR in education; the barriers hindering developing countries from implementing VR in education; the curriculum and professional skills requirements of graduates in the 21st century; and whether the introduction of VR in tax education will be sustainable. This will contribute meaningfully to the current agenda of bringing Africa's education systems in line with best practices globally to produce graduates that are relevant in the 21st century. This section presents a summary of the characteristics found in the review of literature on VR as an educational tool.

3.4.1 Advantages of Virtual Reality in Education

Although the literature reviewed are predominantly from developed countries and across disciplines, the reasons for and advantages of implementing VR in education is universal. This global relevancy of VR in education indicates that some advantages are not restricted to specific countries or regions, and hence, are applicable to developing countries in Africa. The literature suggests that the significance of VR in education is recognised by both developed and developing countries worldwide.

There are several advantages of using VR in education, for example, in the medical and science fields it was found that VR can improve memory function and reduce depression in older people (Roberts, De Schutter, Franks & Radina, 2018) and VR have been used in the treatment of autism with combined cognitive behavioural therapy (Vesisenaho *et al.,* 2019).

It allows students an improved understanding of abstract concepts with no physical referent as it allows participants to simulate scenarios, for, example surgical training for medical students (Barrow, Forker, Sands O'Hare & Hurst, 2019). By allowing students to interact with virtual models in subjects such as medicine, cosmology, physics, geography and biology, greater participation and more engaging learners have been observed in in science technology engineering and mathematics (STEM) education (Cooper *et al.,* 2019, Farshid *et al.,* 2018). Furthermore, VR provides more practice opportunities in training to master a concept, task, procedure or to operate heavy duty equipment (Farshid *et al.,* 2018).

Participants who have used VR described the immersive data visualisation as 'clear', easier to remember and making it easier to go through the steps afterwards again when needed, hence it allows for logical walkthroughs (Zenner *et al.,*2020).

In addition to that, in a practical experiment where participants using VR were compared with participants not using VR, it was found that participants using VR remembered better than those not using VR and they displayed an improved learning experience. It is further argued that enjoyment is linked to students' performance and that VR headsets can have a positive impact on the learning experience (Allcoat & von Mühlenen, 2018).

Equally, VR proved advantageous in tax education when a facilitator created a VR scenario for tax students and saw students immersed in taxation smiling and enjoying the experience while it provided them with the opportunity to see the subject in its practical application (Filer & Holmes, 2018). Students believe that VR is an effective and innovative way to enhance learning and VR immersive teaching as an educational tool can enhance their understanding of the principles of taxation. Furthermore, developing countries are often associated with massification of classes, which affect the quality of education, and a VR teaching intervention may thus be the envisioned student engagement that leads to superior quality education. It allows students to self-direct their immersive learning experience and engage with other students in small groups (du Preez & Hill, 2021).

VR has advantages specifically related to real estate and history and in retail for online shopping. Potential buyers in real estate are accorded an opportunity to virtually walk on the premises and in the house and get a feel of the house without ever visiting the site in person. While history students can tour an exact virtual version of monuments to experience it first- hand without having to travel significant distances. In retail customers can explore 3-D renderings of a firm's products or services without having to leave their homes with the help of VR experiences (Farshid *et al.,* 2018).

In teaching, all learning types could benefit from a learning arrangement since VR headsets allow for complex visual renderings, audio, and movement tracking, which provides for the three learning styles, namely visual, auditory and kinaesthetic, to be satisfied in one application. Additionally, VR headsets share the benefit of mobile learning that can complement traditional learning and have the potential to be an alternative to traditional textbook-style learning with similar performance levels (Allcoat & von Mühlenen,

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2018). Students retain more information and can better apply concepts after participating in VR exercises. It also improves learning outcomes as it provides opportunities for active learning (learn by doing) (Alizadehsalehi, Hadavi & Huang, 2019; Radianti, Majchrzak, Fromm & Wohlgenannt, 2020). Just like with other videos, when a student makes mistakes during exercise questions, they can revisit the videos in an attempt to prevent them from making mistakes again, and this allows facilitators to identify students early who need teaching intervention and to offer assistance to these students to enhance students' learning effects (Yang & Yu ,2019).

In environmental and disaster management scenarios, VR is used for the simulation of realistic, safe workplace scenarios that allow repetition and accuracy since precise measurements can be obtained. Furthermore, it can be used to educate learners from kindergarten to 12th grade efficiently and effectively and increase public awareness regarding natural disasters (Sermet & Demir, 2020).

Digital technologies such as VR equipment is considered essential assets for academic institutions as they can support strategic teaching and learning objectives for education institutions, and it enables students to keep abreast with the latest technologies, bringing returns on the costly investment into technology. It is stated that digital technologies are affordable, available and accessible in developing countries such as Zimbabwe and South Africa and that it can be embraced in teaching and learning practices (Dube & Scott, 2017).

There appears to be a remarkable enthusiasm for VR in education, and the nature of AR and VR promises new teaching and learning models that better meet the needs of the 21st century learner (de Lange & Lodewijk, 2017; Elmqaddem, 2019). It is clear from the above that there are VR has several advantages in education and across disciplines, however some of the articles suggested disadvantages.

3.4.2 Disadvantages of Virtual Reality in Education

Although an overwhelming range of advantages is suggested for the use of VR in education, there are disadvantages. The costs associated with the use of VR in education remains high. It is suggested that when standalone VR headsets are used, it needs high-end computer hardware to run the software, which is currently still expensive, even though the cost for VR equipment has reduced significantly in recent times (Barrow *et al.* ,2019).

Furthermore, generating kinesthetics perceptions often requires complex, large, expensive, and potentially dangerous hardware such as robotic arms. Paired with the high costs of VR equipment are the disadvantages unique to developing countries in Africa that relates to technological failures and the inability of VR to accommodate all the students (du Preez & Hill, 2021).

It is further indicated that there are significant challenges for the general adoption of the technology and that it promotes a model of privilege and exclusion for students from ethnic minorities or those unable to access the environment (Filer & Holmes, 2018).

In addition to the high associated costs, VR can have adverse physical effects on participants' health as they can experience a phenomenon called VR sickness or cybersickness, which can lead to symptoms like disorientation, discomfort, headache and nausea. Alongside the physical health effects is the confusion it causes that make participants feel lost. Furthermore, VR equipment, such as VR helmets, is described as heavy, making it difficult to turn around, and it can get too hot inside for some users (Farshid *et al.,* 2018; Roberts *et al.,* 2018; Zenner *et al.,* 2020; Vesisenaho *et al.,* 2019).

In terms of learning outcomes, it is noted that if VR assignments are inadequately developed and tasks or content are too standardised, participants can get to the end of the process without thinking about actual content, and learning outcomes will not be achieved (Roberts *et al.,* 2018; Vesisenaho *et al.,* 2019; Zenner *et al.,* 2020). Many students are uncertain about learning outcomes and suffer from a lack of understanding about what should be learned, and there is confusion in terms of whether they are required to memorize the virtual world and its objects or focus on acquiring of new skills and competencies (Dengel & Mägdefrau, 2017).

VR applications may be more suited to some areas of education than others (Allcoat & von Mühlenen, 2018). Some studies shows that VR leads to a high sense of presence but have a lesser effect on learning and performance and that some participants indicated that VR educational assignments seemed interesting in the beginning but that they lost interest towards the end and became bored (Vesisenaho *et al.,* 2019).

It is suggested that when analysing VR from a higher education viewpoint, learning theories that guides learning outcomes were often not considered in VR application development. Furthermore, the evaluation of educational VR applications has primarily focused on usability of the VR applications instead of learning outcomes, and immersive

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VR has mostly been a part of experimental and development work rather than being applied regularly in actual teaching. It might require complex changes of the curriculum to shift the focus from teaching declarative knowledge to more practice-oriented content that will require more VR experience for both the facilitator and the participants (Radianti *et al.,*2020).

The suggested disadvantages are believed to hinder the implementation of VR in education, but some articles also specifically highlight barriers that hinder the implementation of VR in education. These barriers are discussed in the next section.

3.4.3 Barriers Hindering the Implementation of Virtual Reality in Education in Developing Countries

Some facilitators take too long to implement VR in education or are hesitant to implement it as they consider the barriers as significant. These barriers include concerns about equity, which suggests that equity does not simply mean providing access or equal access to the digital technology but rather a fair learning opportunity (Lowell & Morris, 2019). The hardware required is expensive and issues such as incompatible phones, physical inability (for example, wearing glasses), low-cost VR goggles and unreliable Wi-Fi connections are all barriers (Barrow *et al. ,*2019; du Preez & Hill, 2021).

Not all participants understand the use of VR equipment, which may create barriers to their ability to understand and complete instructional content involving technology and some participants need time to adapt to new technology systems (Lowell & Morris, 2019; Zenner *et al.,* 2020). Another barrier is age diversity, which means that there may be significant differences in the ages of students, and the older students may be underexposed to technology, which might hinder their learning process and causes them stress (Lowell & Morris, 2019; Yung & Khoo-Lattimore*,* 2019).

Some facilitators noted that little empirical research has been conducted on the learning effects in VR (Vesisenaho *et al.,* 2019). There is a lack of exchange of best practices related to education-oriented VR within and across disciplines and makes academics hesitant to adopt it. Other facilitators believe that the benefits currently associated with VR learning can be as a result of the benefits of active learning, as VR learning is in many instances the same as action (active) learning (Allcoat & von Mühlenen, 2018). Another barrier is that the development of an Immersive Virtual Reality Environment (IVRE) can be

a time-consuming process for the facilitator, and it may require facilitators to regularly update teaching content (Alizadehsalehi *et al.,* 2019; Du Preez & Hill, 2021).

Currently there are more advantages associated with using more expensive equipment such as wearable technology, which indicates a compromise in the quality of the learning experience if cheaper equipment is used, and cheaper equipment may be the only available equipment in developing countries, hence some facilitators are reluctant to use VR in their educational set-up (Phipps *et al.,*2016).

In some developing countries access to technology and internet is a challenge since it is considered luxury items that is only accessible to government offices, excluding public institutions such as learning institutions (Mataka *et al.,* 2020). Despite the barriers, the research indicates that the implementation of VR shows immense potential and that is can be sustainable. This will be discussed next.

3.4.4 Sustainability of Virtual Reality in Education in Developing Countries

VR has been described as the learning aid of the 21st century (Radianti *et al.*, 2020). It has the potential to revolutionise the fields of entertainment, gaming, and education since it will affect the way we interact with the real world and will be widely adopted in all domains (Elmqaddem, 2019; Vesisenaho *et al.*, 2019). It is estimated that the VR market, including hardware, networks, software and content, will reach US\$ 692 billion by 2025 and will be a trillion-dollar (US) industry by the year 2035 (Citigroup, 2016; Cooper *et al.*, 2019). This is an indication of how popular VR is and will continue to become over the next 15 years. One study announced 2016 as the year of virtual reality (Aczel, 2017), and this is supported by the rise in research from academics across disciplines for the use of VR in education. Learning institutions generally keep abreast of societal trends, including the use and adoption of digital technologies (Cooper *et al.*, 2019). Therefore, it is conceivable to see how VR will increasingly become an educational tool used by schools. The 4IR agenda has contributed to the excitement for the use of digital technology. Smartphones have become more accessible, and the popularity of AI have contributed to more cost-effective and high-performance sensor technologies (Sermet & Demir, 2020). Although AI is in its infancy in Africa, third world countries benefit substantially from this since digital technology has become much cheaper and more easily accessible.

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The presence of the newly available 5G cellular network technology in some developing countries will result in increasing mobile streaming capabilities for faster transfers of complex and high-resolution 3D models, denser sensor coverage and data points with a more comprehensive and detailed reporting (Sermet & Demir, 2020). A vast number of study programmes in learning institutions requires the teaching of declarative knowledge in lectures, and students are expected to memorise what they have learned for the exams. The use of VR applications could support this learning method so students can enjoy lectures (Radianti *et al.,* 2020). In 2016, VR equipment became more affordable when head mounted devices were introduced at low cost, and it is now available and accessible (Du Preez & Hill, 2021), indicating that more students would be able to acquire this equipment. The sustainability of VR in education can be linked to the available VR equipment and software in the market.

3.4.5 Virtual Reality Technology Available in Africa

The research does not specifically suggest that all hardware and software can be found in developing countries; however, because the concept of VR is universal, it is worth noting all VR technology as future researchers might want to explore the availability of this digital technology, specifically in Africa. Furthermore, with the technological advancements that improve logistical arrangements with regard to shipping, it has become increasingly easy to get a hold of equipment. In order to create a VR scenario, both VR software and hardware are required. Smartphone VR requires less accelerated hardware, which is cheap or can even be created by the user themselves, for example, Google Cardboard (Barrow *et al.*, 2019). The current available VR technology are the VR headsets (that look like giant matte black ski goggle) like Oculus Rift, Samsung Gear VR, Google Art; PC-based VR headsets like the HTC Vive and Oculus Rift, Vive Focus, Google Earth, Bow Fight guided meditation applications, Oculus, Vive, Samsung Gear, Samsung Odyssey, Epson's wearable smart glasses, the Moverio BT-200 (Allcoat & von Mühlenen, 2018; Farshid *et al.*, 2018; Phipps *et al.*, 2016; Radianti *et al.*, 2020; Vesisenaho *et al.*, 2019). Other digital technology includes the Rift Core 2.0 that offers a brand-new system interface, Oculus Dash and Oculus Home and a Dash and Oculus Touch (Elmqaddem, 2019). The most active virtual world platform is Second Life, an internet-based virtual world where avatars socialise, network and create their own virtual spaces (Yung & Khoo-Lattimore, 2019). Once the available VR technology is determined, it should be aligned to

the study curriculum, and the skills requirements that will be relevant in the 4IR for the tax profession.

3.4.6 Taxation Curriculum, Tax Profession and the 4IR

Some of the predictions associated with the 4IR is the change in the composition and skillsets of the workforce, and it is anticipated that there will be labour displacements on the one hand and there will be a shift towards new and different jobs and toward new skillsets, on the other hand. This means that a job description will involve interaction with information and communication technologies and the workforce will be able to work from anywhere at any time as they have autonomy. To be relevant in the 4IR, fundamental restructuring of many of the regulations pertaining to work, workplaces, taxation, and welfare is required (de Ruyter *et al.,* 2019). Developing economies are already faced with high levels of youth unemployment and long transition periods for graduates from graduation to regular employment, and the transitional labour market makes it necessary to re-examine the relationship between education, credentials, employment and careers (de Ruyter *et al.,* 2019).

It is anticipated that everything that can be digitised and automated will be embedded into intelligent machines, and fundamentally, jobs based on codified knowledge will be performed by robots. This innovation calls for a paradigm shift from the traditional ways of doing 'work' to the development, deployment and exploitation of technologies. The response from institutions of learning should strengthen the linkages between academia and industry, and collaborations for industrial development should align the support of the adoption and experimentation of new technologies with the study curriculums to increase the technological capacity of organisations. Furthermore, educational institutions should also create mechanisms to reinvestigate the teaching and learning objectives of courses to highlight technological changes. Digital technologies such as VR can enhance the effectiveness of teaching and learning (Lee *et al.,*2018).

Lastly, the rise of AI, robotics, and automation may bring about different change than past innovations, and it threatens to dislocate the tax systems that relies on human effort to raise revenue through income or payroll taxes. This encourages the debate for AI and digital taxes, and it should be high on the agenda of curriculum developers to include it (Kovace, 2020).

3.5   RESEARCH ETHICS

Ethics in research involve the integrity of collecting data, interpreting the data, and drawing conclusions from the research (Fouka & Mantzorou (2011:3).

The research ethics applicable to this study are discussed below (Thomas & Hodges, 2010):

- Honesty: The research objectives, procedures and findings are presented in a truthful, open and honest manner.
- Evade research bias: The reporting of the research findings does not neglect the findings of other researchers or valid data that may contradict the research findings of this study.
- Acknowledging the work of others: This study does not plagiarise the work of others, and the work and ideas of researchers are clearly identified and acknowledged through appropriate referencing.

CHAPTER 4
CONCLUSION

4.1 INTRODUCTION

In the previous chapter, the data analysis and the results were presented and discussed.

This final chapter concludes the study by expanding on the findings and presenting an overall conclusion. The framework in which the research question of the study was answered is explained, together with the limitations of the study and recommendations for future studies around this topic.

4.2 REFLECTION ON ADDRESSING THE RESEARCH QUESTION AND OBJECTIVES

The main research objective of this study was to systematically explore the existing body of literature related to VR as an educational tool and its potential to enhance tax education at institutions of higher education in developing countries by focusing on relevant articles published in quality academic journals. This main objective was supported by the research sub-objectives that directed the research. The findings of this study are presented in a conclusive summary below using the research sub-objectives as basis and followed by an overall conclusion for the study.

To answer this research question, the following research objectives were set:

- To identify the reasons for the implementation of VR in tax education by analysing a sample of developed countries with the best ranked education systems;
- To compare the benefits and challenges of VR in tax education based on literature;
- To analyse the barriers hindering developing countries' implementation of VR as an enhancing tool for tax education; and
- To understand whether implementing VR in developing countries as a tool to enhance tax education is a sustainable solution.

This section highlights the eminent ideas linked to each of the research sub-objectives and responds to the main research objective.

The implementation of VR in tax education is linked to the advantages of the use of VR in education and are wide ranging. These advantage includes health benefits relating to

memory function and depression; better understanding and memorising of abstract concepts; greater student participation and engagement; more practice opportunities for mastering content; positive learning experiences that results in superior quality education; practical application of tax education; low cost field trips; and it complements traditional teaching and supports strategic teaching and learning objectives for education institutions.

However, VR in education is not without disadvantages. One of the significant disadvantages relates to high costs for VR equipment that promotes a model of privilege and exclusion for students from ethnic minorities. Paired with the high costs is the common technological failures. Additionally, it sometimes requires potentially dangerous hardware that can affect the physical health of participants. Lastly, there is the possibility that it can fail to meet the learning objectives and competencies.

In addition to the disadvantages of VR in education, there are barriers that hinders the implementation of VR in education in developing countries. These barriers include equity, which is defined as a fair learning opportunity for everyone and equal access to VR equipment; diversity in generations creates for a lack of understanding of abstract concepts; little empirical research on the learning effects of VR; and it is a time-consuming process to develop IVRE.

Lastly, the sustainability of VR in developing countries if implemented were assessed and it was noted that because of the popularity of VR in education and it is predicted to continue to rise has, made smartphones easily accessible and contributes to cost effective technology. Furthermore, the presence of the 5G cellular network in some developing countries increase mobile streaming capabilities, which offers a sustainable solution to the implementation of VR in education.

4.3   LIMITATIONS

In carrying out the study, the following limitations were encountered:

- There was limited literature because not many empirical or longitudinal studies have been carried out on the implementation of VR in education in developing countries in Africa. This limited the research from making recommendations about whether VR in tax education should be integrated in developing countries.
- Most of the sample comprised of developed countries that were analysed to conclude whether VR in education could be beneficial for developing countries in

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Africa. This study does not include a detailed comparison of the differences between a developed and a developing country to reach this conclusion.

- The advantages of the use of VR in education discussed in section 3.4.1. does not consider any bias on the part of the individuals expressing their opinions. There may be a conflict of interest in instances where individuals expressing an opinion on the success of the use of VR in education were involved in the design and implementation of such VR learning activities.

- Limited attention was paid to the perceptions of students in developing countries in Africa and whether they will react positively to VR as an educational tool. This includes the risk that the excitement and participation from the individuals, as provided by the one longitudinal study for tax students (Du Preez & Hill, 2021), may be short lived.

- This study does not provide any exhaustive information relating to the analysis of the actual effects of the implementation of VR in education, especially relating to taxation courses.

4.4   RECOMMENDATION FOR FUTURE RESEARCH

In light of the limitations of this study, future research areas are recommended. One such area is empirical or longitudinal studies to assess the feasibility of the implementation of VR in tax education in developing countries. Another recommendation is the exhaustive analysis of the effects of VR in tax education after its implementation and whether it improves student performances. Thorough studies on the most appropriate VR hardware and software that is available in developing countries in Africa are also recommended. This could be incorporated into an experimental study on participants from developing countries in Africa, providing insights into how different types of VR equipment or systems may influence the performance of taxation students.

4.5   CONCLUDING REMARKS

Despite the limitations, disadvantages and barriers, VR has the potential to be successfully applied as a tax educational tool in developing countries in Africa. The benefits associated with its use in education clearly outweigh its disadvantages, and the effects of the barriers and limitations can be carefully mitigated or replaced with alternative options, such as a controlled environment. The technological advancements during the last five years allow

students easier access to high-tech tools, such as multi-media images, sound and videos that are driven by the IR4. The global growing interest in the use of VR in education over this period indicates that its use can be adopted to enhance learning for taxation students in developing countries. Digital technology, such as VR, promises improved student engagement that can lead to superior quality education.

However, consideration should be given to addressing critical factors for the involvement of educationalists to provide input for the correct design and deployment of VR technology that will be suitable in developing countries in Africa. Finally, the use of VR in tax education should be constantly reviewed to improve and make recommendations for its use in developing countries in Africa to ensure that graduates relevant in the 21st century are produced. When the benefits are matched against the barriers, the use of VR can unquestionably be used as a tax educational tool in developing countries.

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APPENDIX A:
DECLARATION OF PLAGIARISM

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DEPARTMENT OF TAXATION

Declaration Regarding Plagiarism

The Department of Taxation emphasises integrity and ethical behaviour with regard to the preparation of all written assignments. Although the lecturer will provide you with information regarding reference techniques, as well as ways to avoid plagiarism (see the *"Guidelines on Referencing"* document), you also have a responsibility to fulfil in this regard. Should you at any time feel unsure about the requirements, you must consult the lecturer concerned before submitting an assignment.

You are guilty of plagiarism when you extract information from a book, article, web page or any other information source without acknowledging the source and pretend that it is your own work. This does not only apply to cases where you quote the source directly, but also when you present someone else's work in a somewhat amended (paraphrased) format or when you use someone else's arguments or ideas without the necessary acknowledgement. You are also guilty of plagiarism if you copy and paste information <u>directly</u> from an electronic source (e.g., a web site, e-mail message, electronic journal article or CD-ROM) without paraphrasing it or placing it in quotation marks, <u>even if you acknowledge the source</u>.

You <u>are not allowed</u> to submit another student's previous work as your own. You <u>are furthermore not allowed</u> to let anyone copy or use your work with the intention of presenting it as his/her own.

Students who are guilty of plagiarism will forfeit all credits for the work concerned. In addition, the matter will be referred to the Committee for Discipline (Students) for a ruling. Plagiarism is considered a serious violation of the University's regulations and may lead to your suspension from the University. The University's policy regarding plagiarism is available on the Internet at *http://www.library.up.ac.za/plagiarism/index.htm.*

For the period that you are a student at the Department of Taxation, the following declaration must accompany <u>all</u> written work that is submitted for evaluation. No written work will be accepted unless the declaration has been completed and is included in the particular assignment.

Student	
I (full names & surname):	Geraldo Jansen
Student number:	217210000

Declare the following:
1. I understand what plagiarism entails and am aware of the University's policy in this regard.
2. I declare that this assignment is my own, original work. Where someone else's work was used (whether from a printed source, the Internet or any other source) due acknowledgement was given and reference was made according to departmental requirements.
3. I did not copy and paste any information <u>directly</u> from an electronic source (e.g., a web page, electronic journal article or CD ROM) into this document.
4. I did not make use of another student's previous work and submitted it as my own.
5. I did not allow and will not allow anyone to copy my work with the intention of presenting it as his/her own work.

APPENDIX B:

LANGUAGE EDITING CERTIFICATE

WORDPLAY EDITING
Copy Editor and Proofreader
Email: karien.hurter@gmail.com
Tel: 071 104 9484
Website: http://wordplayediting.net/

25 August 2021

To Whom It May Concern:

This letter is to confirm that *Virtual Reality as a Tax Educational Tool in Developing Countries* by Geraldo Jansen was edited by a professional language practitioner.

Regards,

Karien Hurter